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# Mortality in people with mental disorders in the Czech Republic: a nationwide, register-based cohort study

Dzmitry Krupchanka, Karolína Mladá, Petr Winkler, Yasser Khazaal, Emiliano Albanese



## Summary

**Background** The region of central and eastern Europe is estimated to have high rates of premature mortality due to mental disorders. However, epidemiological evidence is scarce and insufficient to inform policy actions and health system development. We aimed to assess mortality associated with mental disorders in the Czech Republic.

**Methods** We did a nationwide, register-based, retrospective cohort study using routinely collected health data from two nationwide registries in the Czech Republic: the register of inpatient discharges (from Jan 1, 1994, to Dec 31, 2013) and the causes of death registry (from Jan 1, 1994, to Dec 31, 2014). We first identified all individuals discharged from mental health institutions with WHO International Classification of Diseases tenth edition (ICD-10) diagnoses of mental and behavioural disorders (from 1994 to 2013). We then did a deterministic individual-level linkage of these data with all-cause mortality data for the whole period (1994–2014). Standardised mortality ratios (SMRs) and 95% CIs were calculated for the year 2014, comparing deaths in people with mental and behavioural disorders discharged from psychiatric hospitals with deaths in the general population.

**Findings** The final study population comprised 283 618 individuals. 3819 of these individuals died in 2014, corresponding to a mortality risk more than two times higher than that of the general population (SMR estimate 2·2; 95% CI 2·2–2·3). Differences in SMR estimates across diagnostic groups were substantial, with the highest SMR for substance use disorders (3·5; 95% CI 3·4–3·7) followed by schizophrenia, schizotypal, and delusional disorders (2·3; 2·1–2·5), personality disorders (2·3; 2·0–2·6), neurotic, stress-related, and somatoform disorders (1·8; 1·6–1·9), and mood (affective) disorders (1·6; 1·5–1·7).

**Interpretation** Mortality among people with mental disorders in the Czech Republic is markedly higher than in the general population. Our findings should stimulate and inform policy in the central and eastern Europe region, as well as ongoing national mental health-care reforms in the Czech Republic.

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## Introduction

Excess mortality among people with mental disorders is common. Some studies have reported a two-times to three-times higher mortality risk in this population compared with the general population.<sup>1–3</sup> Other studies suggest that men and women diagnosed with severe mental disorders live, on average, 20 years and 15 years less than the general population.<sup>4</sup> This substantial gap in life expectancy is likely to be increasing because mortality continues to fall in the general population worldwide, and for all age groups, but not in people affected by mental disorders.<sup>5</sup> And yet, this mortality gap could be largely reduced or even avoided altogether.<sup>6</sup>

According to the 2010 Global Burden of Disease study, mental and substance use disorders were the leading cause of years lived with disability worldwide, accounting for a substantial proportion of all disability-adjusted life-years.<sup>7</sup> In central and eastern Europe, the age-standardised disability-adjusted life years (per 100 000 individuals) and years of life lost (ie, premature mortality) associated with

mental and substance use disorders varied markedly across countries and were exceptionally high, particularly for depressive and alcohol use disorders.<sup>7</sup> However, evidence about mortality due to mental ill health in central and eastern Europe is scarce. During the past 25 years, only 23 epidemiological papers (of which 14 are from peer-reviewed journals) have been published in the whole region, which encompasses 24 countries. None of the four papers from the Czech Republic focused on mortality, nor were they peer-reviewed publications.<sup>8</sup> The overall state of mental health care in central and eastern Europe is a “blind spot on the global mental health map”,<sup>8</sup> and one of the unknown aspects is whether and to what extent the high prevalence of depressive, alcohol, and substance-use disorders directly contributes to premature mortality in the region.<sup>9,10</sup>

Mental health-care reform is ongoing in the Czech Republic, shifting services from predominantly institutionalised care to community-based health service provision for a population of ten million inhabitants.<sup>11</sup> In Nordic countries, deinstitutionalisation was associated

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### Research in context

#### Evidence before this study

We searched for and retrieved papers published from Jan 1, 1989, to Aug 8, 2016, from MEDLINE, PsycINFO, Embase, Web of Science, and the Cochrane Library. Combinations of search terms were used, referring to appropriate regional and mental health topics (including mental health epidemiology). We applied no language restrictions and made all attempts to include sources from the grey literature and expert opinions from participating countries. We found a substantial shortage of epidemiological evidence from the central and eastern Europe region, with only 23 epidemiological papers, of which 14 were published in peer-reviewed journals, for the whole region, and no register-based study in the whole region about mortality associated with mental disorders—an evidence gap we referred to as “a blind spot on the global mental health map”. Our scoping review was published in 2017.

#### Added value of this study

This study is, to our knowledge, the first to assess mortality associated with mental and behavioural disorders in central and

eastern Europe by use of deterministic linkage of nationwide databases of routinely collected health data. This analysis was based on data collected between Jan 1, 1994, and Dec 31, 2014, in the Czech Republic. We found that, compared with the general population, individuals with a clinical history of mental disorders had up to three-times higher mortality, varying by age and cause of death. We also describe the record linkage procedures and processes across registries to inform and stimulate further research in other countries.

#### Implications of all the available evidence

Our findings have relevant implications for the ongoing mental health-care reforms in the Czech Republic, and the methods used in this study could prompt similar epidemiological studies in other regions with existing mental health registries but where research on this topic is still scant. Empirical evidence and implementation research are warranted to design and scale up specific interventions and to inform structural national reforms of mental health services, policy, plans, and programmes aimed at closing the mental health mortality gap.

See Online for appendix

with a reduction of the mortality gap between people with severe mental illnesses and the general population.<sup>4</sup> However, descriptive data about temporal trends in this mortality gap are rarely or poorly collected to assess the responsiveness and adequacy of mental health systems and to monitor progress.

We aimed to explore mortality associated with mental and behavioural disorders in the Czech Republic. In particular, we aimed to compare annual mortality, age, and causes of death in people with a history of discharge from a psychiatric hospital versus the general population in 2014.

## Methods

### Study design

We did a register-based, retrospective cohort study based on individual-level linkage of nationwide data collected in the Czech Republic between Jan 1, 1994, and Dec 31, 2014. We used two nationwide registries maintained by the Institute of Health Information and Statistics of the Czech Republic: the register of inpatient discharges and the causes of death registry. The National Institute of Mental Health was granted full access to data from 1994 to 2014.

The register of inpatient discharges contains data routinely collected by the Institute of Health Information and Statistics through the health information system for monitoring service provision in the Czech Republic. The database contains about 2·3 million hospital records for each calendar year, and about 2·5% (nearly 60000) of these datapoints are related to psychiatric hospitalisations (defined as inpatient psychiatric admissions, diagnoses, treatments, and discharges). These data are recorded on a

standard form (appendix pp 1,2) that health professionals fill out upon patient discharge and send directly to the Institute of Health Information and Statistics. Completion of this form is mandatory for each patient discharged across all health-care facilities. Key clinical and health-care information about a patient at the time of discharge is reported on the form. The database comprises variables including date of birth, sex, marital status, occupation, place of and reason for admission, primary and comorbid diagnoses, date of admission and discharge, date of first symptoms, and type of admission and discharge.

Death certificates are routinely used by physicians for all deaths in the Czech Republic (appendix pp 3–6). Death certificates are promptly sent to the national register office. The Czech Statistical Office centrally manages the mortality database, which contains the following information: place of death, time and date of death, age at death, sex, marital status, education, nationality, place of residence, primary cause of death according to WHO International Classification of Diseases tenth edition (ICD-10), whether an autopsy was done, and age of spouse at death. The database contained about 2·2 million observations from 1994 to 2014.

This study was approved by the Ethical Committee of the National Institute of Mental Health on June 15, 2016 (N 130/16), and complies with the Convention on Human Rights and Biomedicine and Act no. 101/2000 on protection of personal information.

### Selection criteria, data linkage, and data cleaning

We used the database of all-cause inpatient hospital discharges to identify all individuals discharged from

Czech mental health institutions between Jan 1, 1994, and Dec 31, 2013, with diagnoses of mental and behavioural disorders. We then deterministically linked these data with data from the all-cause mortality database; all observations were retained. The record-linkage was done with an encrypted individual personal identifier (birth number). Birth number is an individual personal identifier assigned to each resident of the Czech Republic at birth or when a person is officially registered as a resident of the country. It consists of ten numbers combining the six digits of the individual's date of birth (yy/mm/dd) with four random digits. We excluded incorrect, implausible (ie, date of discharge after the registered date of death), and missing data, and data of those individuals who died before Jan 1, 2014. In line with other studies on mortality,<sup>4,5,12</sup> we also excluded people with intellectual disabilities (ICD-10: F70–79) or mental disorders due to known physiological conditions (F00–09) because premature death is inherent to these conditions. We also excluded people younger than 15 years and older than 84 years to avoid the effects of dilution and inflation on mortality.

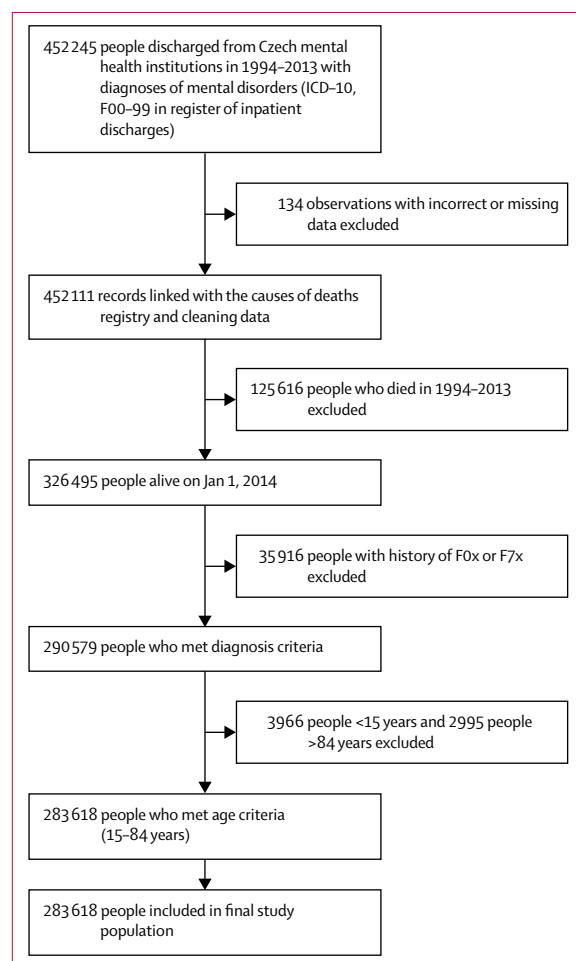


Figure 1: Study selection

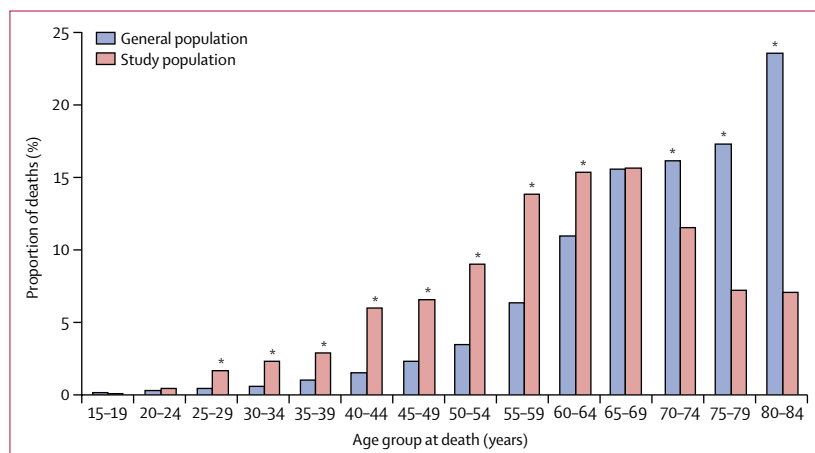
The final study population consisted of individuals with a history of discharge from Czech mental health institutions, with relevant ICD-10 diagnoses

	Study population	Deaths
Total	283 618 (100.0%)	3819 (100.0%)
Sex		
Men	151 667 (53.5%)	2379 (62.3%)
Women	131 951 (46.5%)	1440 (37.7%)
Age group, years		
15–24	24 339 (8.6%)	21 (0.6%)
25–34	56 106 (19.8%)	181 (4.8%)
35–44	62 824 (22.2%)	378 (9.9%)
45–54	52 510 (18.5%)	613 (16.0%)
55–64	52 837 (18.6%)	1115 (29.2%)
65–74	27 355 (9.6%)	1 005 (26.3%)
75–84	7 647 (2.7%)	506 (13.2%)
Marital status		
Undisclosed	9 318 (3.3%)	156 (4.1%)
Unmarried	130 051 (45.9%)	843 (22.1%)
Married	89 626 (31.6%)	1451 (38.0%)
Divorced	45 421 (16.0%)	1013 (26.5%)
Widowed	9 202 (3.2%)	356 (9.3%)
Employment status		
Unemployed	187 875 (66.2%)	2880 (75.5%)
Managers	9 197 (3.2%)	89 (2.3%)
Researchers and headworkers	3 182 (1.1%)	36 (1.0%)
Professionals	13 128 (4.7%)	104 (2.7%)
Lower administrative workers	7 491 (2.6%)	47 (1.2%)
Employed in services	20 136 (7.1%)	157 (4.1%)
Farm and forest workers	1 673 (0.6%)	20 (0.5%)
Skilled workers	25 716 (9.1%)	307 (8.0%)
Operating personnel	3 655 (1.3%)	37 (1.0%)
Unskilled workers	11 565 (4.1%)	142 (3.7%)
Diagnostic group (ICD-10)*		
F10–19 (Disorders due to psychoactive substance use)	92 271 (27.2%)	1 899 (41.4%)
F20–29 (Schizophrenia, schizotypal, and delusional disorders)	49 822 (14.8%)	724 (15.8%)
F30–39 (Mood [affective] disorders)	38 061 (11.3%)	616 (13.4%)
F40–48 (Neurotic, stress-related, and somatoform disorders)	92 995 (27.5%)	958 (20.9%)
F50–59 (Behavioural syndromes associated with physiological disturbances and physical factors)	6 001 (1.8%)	26 (0.6%)
F60–69 (Disorders of adult personality and behavior)	32 993 (9.8%)	309 (6.7%)
F80–89 (Disorders of psychological development)	1 393 (0.4%)	1 (0.0%)
F90–99 (Behavioural emotional disorders with onset usually occurring in childhood or adolescence)	24 152 (7.2%)	54 (1.2%)
Individuals with a history of multiple diagnoses	43 862 (15.5%)	609 (15.9%)

Data are n (%). The study population comprises individuals with a history of discharge from Czech mental health institutions between Jan 1, 1994, and Dec 31, 2013, with ICD-10 recorded diagnoses of mental disorders, and who were alive on Jan 1, 2014. Mortality data shown for individuals within the study population who died between Jan 1, 2014, and Dec 31, 2014. ICD-10=WHO International Classification of Diseases tenth edition. \*Individuals with several hospital admissions with diagnoses from different diagnostic groups were included several times in different groups accordingly.

Table 1: Sociodemographic characteristics of the study population

(F10–19; F20–29; F30–39; F40–48; F50–59; F60–69; F80–89; and F90–99; and not F00–09 and F70–79), and who were alive on Jan 1, 2014.



**Figure 2: Age at death in the study population versus the general population in 2014**

The study population comprises people with a history of discharge from Czech mental health institutions between Jan 1, 1994, and Dec 31, 2013, with ICD-10 recorded diagnoses of mental disorders and who were alive on Jan 1, 2014. ICD-10=WHO International Classification of Diseases tenth edition. \*Post-hoc two-sample z test for proportion showed significant differences between the study population and the general population ( $p<0.0001$ ), except for age groups of 15–24 years ( $p=0.10$ ), 25–29 years ( $p=0.23$ ), and 65–69 years ( $p=0.87$ ). † $\chi^2$  goodness of fit test showed significant differences between the study population and the general population ( $p<0.0001$ ).

	Study population	General population	Mortality ratio (95% CI)
Certain infectious and parasitic diseases (A00–B99)	58 (1.5%)	1245 (1.6%)	1.4 (0.9–2.2)
Neoplasms (C00–D48)	718 (18.8%)	24 182 (32.0%)	0.9 (0.8–1.1)
Endocrine, nutritional, and metabolic diseases (E00–90)	102 (2.7%)	2789 (3.7%)	1.1 (0.5–5.6)
Mental and behavioural disorders (F00–F99)	66 (1.7%)	629 (0.8%)	3.2 (2.1–4.9)
Diseases of the nervous system (G00–99)	96 (2.5%)	1906 (2.5%)	1.6 (1.1–2.1)
Diseases of the circulatory system (I00–99)	1225 (32.1%)	29 637 (39.2%)	1.3 (1.2–1.4)
Diseases of the respiratory system (J00–99)	235 (6.1%)	4430 (5.9%)	1.6 (1.3–2.0)
Diseases of the digestive system (K00–93)	458 (12.0%)	3813 (5.0%)	3.7 (3.1–4.3)
Symptoms, signs, and abnormal clinical and laboratory findings (R00–99)	75 (2.0%)	887 (1.2%)	2.6 (1.7–2.8)
Other causes of death*	49 (1.3%)	1270 (1.7%)	1.2 (0.7–1.9)
External causes of morbidity and mortality (V01–Y98)	737 (19.3%)	4745 (6.3%)	4.8 (4.3–5.4)
Intentional self-harm (X60–84)	312 (8.2%)	1488 (1.8%)	6.5 (5.3–7.8)
Other external causes of morbidity and mortality (V01–X56, X95–Y98)	425 (11.1%)	3257 (4.5%)	4.0 (3.4–4.7)
<b>Total</b>	<b>3819 (100.0%)</b>	<b>75 533 (100.0%)</b>	<b>2.2 (2.1–2.9)</b>

Data are n (%), unless otherwise stated. The study population comprises individuals with a history of discharge from Czech mental health institutions between Jan 1, 1994, and Dec 31, 2013, with ICD-10 recorded diagnoses of mental disorders, and who were alive on Jan 1, 2014. Numbers are expressed as percentages of all deaths. Mortality ratios calculated comparing the study population with the general population. ICD-10=WHO International Classification of Diseases tenth edition. \*Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–89); diseases of the skin and subcutaneous tissue (L00–99); diseases of the musculoskeletal system and connective tissue (M00–99); diseases of the genitourinary system (N00–99); congenital malformations deformations and chromosomal abnormalities (Q00–99); and pregnancy, childbirth, and the puerperium (O00–99).

**Table 2: Distribution of causes of death in the general population and among the study population in 2014**

## Data analysis

We analysed all-cause mortality in 2014 (all deaths occurring between Jan 1, 2014, and Dec 31, 2014) for individuals with and without a history of discharge from psychiatric inpatient facilities, and calculated the standardised mortality ratio (SMR) between these two groups (with 95% CI) by age and sex for each group of mental disorders and for individuals with a history of multiple diagnoses. The formula for the SMR calculation is provided in the appendix (p 11). We plotted the percentage distribution of deaths by age for each diagnostic category, for the whole group, separately for men and women, and in the general population. We also did  $\chi^2$  tests and post-hoc two-sample z tests for proportions to make formal comparisons of age distributions with the general population. Finally, we derived and analysed cause of death for different groups of mental and behavioural disorders and presented mortality ratios with 95% CIs for each diagnostic category and for the whole group.

All statistical analyses were done in Stata IC 14, combined with Microsoft Access and Oracle database 9i Release 2 (version 9.0.2) to increase data management capability.

## Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## Results

The final study population comprised 283 618 individuals (figure 1). Sociodemographic characteristics of the study population are summarised in table 1. The mean age was 45.3 years (SD 15.4), and the proportion of men to women was similar. 187 875 (66.2%) people were unemployed and 89 626 (31.6%) were married. Mental and behavioural disorders due to psychoactive substance use (F10–19; representing 27.2% of primary diagnoses at discharge) and those classified as neurotic, stress-related, and somatoform disorders (F40–48; 27.5%) were two major subgroups, followed by schizophrenia, schizotypal, and delusional disorders (F20–29; 14.8%), and mood (affective) disorders (F30–39; 11.3%). 43 862 (15.5%) people had a history of multiple diagnoses of mental and behavioural disorders. Additional information about this group is presented in the appendix (pp 7,8).

3819 individuals within the study population died between Jan 1, 2014, and Dec 31, 2014. Among those who died, 62.3% were men, 75.5% were unemployed, and 38.0% were married (table 1).

In 2014, individuals who had received a diagnosis of any mental disorder were, on average, significantly younger when they died than those in the general population ( $p<0.0001$ ; figure 2). This difference remained when

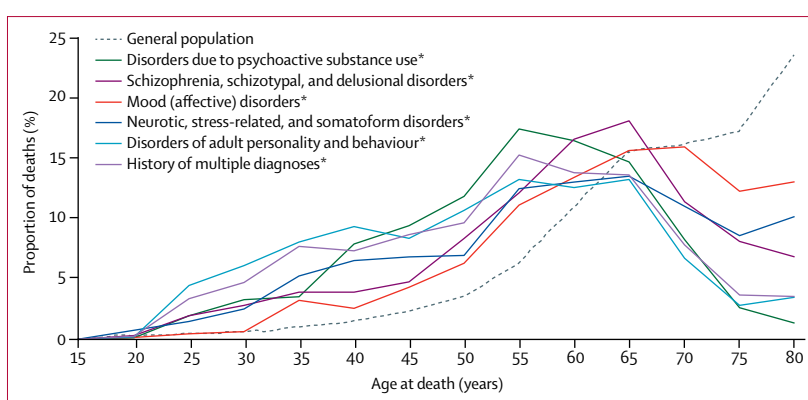


men and women were compared separately ( $p < 0.0001$ ; appendix p 9). The peak in mortality (the age group with the highest proportion of deaths) among those with a history of mental illness was 60–64 years, and more than two decades later (80–84 years) in the general population (figure 2).

Mortality ratios with 95% CIs and the proportion of deaths for each diagnostic category of the study population and the general population in 2014 are presented in table 2 and in the appendix (p 10). Distributions of age at death for each diagnostic group are presented in figure 3, and separately for men and women in the appendix. Peaks in mortality varied across the disorders but appeared at earlier ages than in the general population for all groups of diagnoses. The  $\chi^2$  and post-hoc test of proportions rejected the null hypothesis of no difference in the distribution of data in age categories when comparing the whole study population and each diagnostic category separately with the general population ( $p < 0.0001$ ).

The overall SMR for individuals treated in hospital for any mental disorder compared with the general population was estimated at 2.2 (95% CI 2.2–2.3) and differed across diagnostic groups (table 3). The highest ratios were for mental and behavioural disorders due to psychoactive substance use (F10–19; SMR 3.5; 95% CI 3.4–3.7); schizophrenia, schizotypal, and delusional disorders (F20–29; 2.3; 2.1–2.5); and personality disorders (F60–69; 2.3; 2.0–2.6); followed by neurotic, stress-related, and somatoform disorders (F40–48; 1.8; 1.6–1.9) and mood (affective) disorders (F30–39; 1.6; 1.5–1.7). Those with a history of multiple diagnoses had an estimated SMR of 2.9 (95% CI 2.7–3.2; table 3).

Although the distribution of cause of death varied across the diagnostic groups of mental disorders, cardiovascular diseases (ICD-10 I00–I99) were the leading cause of death in all groups and in the general population (contributing to 32.1% of deaths in the study population and 39.2% in the general population), with a mortality ratio of 1.3 (95% CI 1.2–1.4; table 2). However, the proportion of deaths due to external causes was more than three times higher in people with a history of discharge from a psychiatric hospital for mental disorders than in the general population (19.3% vs 6.3%; mortality ratio 4.8 [95% CI 4.3–5.4]), and the proportion of deaths due to intentional self-harm was even higher (8.2% vs 1.8%; 6.5 [95% CI 5.3–7.8]). Mortality directly caused by mental and behavioural disorders was higher among individuals with a history of discharge from a psychiatric hospital than among the general population (mortality ratio 3.2 [95% CI 2.1–4.9]), as was death because of symptoms, signs, and abnormal clinical and laboratory findings (2.6 [1.7–2.8]), death from diseases of the nervous system (1.6 [1.1–2.1]), and death from diseases of the respiratory system (1.6 [95% CI 1.3–2.0]; table 2). The proportion of individuals with diagnosed mental disorders who died from gastrointestinal diseases



**Figure 3: Age at death in the general population in 2014 and among each diagnostic category of the study population**

The study population comprises people with a history of discharge from Czech mental health institutions between Jan 1, 1994, and Dec 31, 2013, with ICD-10 recorded diagnoses of mental disorders and who were alive on Jan 1, 2014. ICD-10=WHO International Classification of Diseases tenth edition.  $\chi^2$  goodness of fit test showed significant differences between the study population and the general population ( $p < 0.0001$ ).

	SMR	95% CI
General population	1 (ref)	..
Any diagnoses	2.2	2.2–2.3
Disorders due to psychoactive substance use (F10–19)	3.5	3.4–3.7
Schizophrenia, schizotypal, and delusional disorders (F20–29)	2.3	2.1–2.5
Mood (affective) disorders (F30–39)	1.6	1.5–1.7
Neurotic, stress-related and somatoform disorders (F40–48)	1.8	1.6–1.9
Disorders of adult personality and behaviour (F60–69)	2.3	2.0–2.6
Individuals with a history of multiple diagnoses	2.9	2.7–3.2

The study population comprises individuals with a history of discharge from Czech mental health institutions between Jan 1, 1994, and Dec 31, 2013, with ICD-10 recorded diagnoses of mental disorders, and who were alive on Jan 1, 2014. ICD-10=WHO International Classification of Diseases tenth edition. SMR=standardised (by age and sex) mortality ratio. Individuals with more than several hospital admissions with diagnoses from different diagnostic groups were included several times into different groups accordingly. SMRs for ICD-10 categories F50–59 and F80–89 were not calculated because the number of people in these two categories was not sufficient for deriving any meaningful estimations.

**Table 3: Standardised annual mortality ratios of the study population in comparison with the general population in 2014**

(K00–93) was substantially higher than in the general population (mortality ratio 3.7 [95% CI 3.1–4.3]), especially within the subgroup of those with substance use disorders (19.2% in those with substance use disorders vs 5.0% in the general population). Mortality due to other health conditions did not differ substantially (table 3; appendix p 10).

## Discussion

The results of this study show that people with a history of discharge from a psychiatric hospital in the Czech Republic had increased all-cause mortality in 2014 compared with the general population. Individuals diagnosed with mental and behavioural disorders died significantly earlier than individuals in the general population, and although the leading cause of death (cardiovascular diseases) was consistent, mortality from other causes markedly varied between the two groups.

This study is, to our knowledge, the first to analyse mortality associated with mental illness in central and eastern Europe. Major strengths of our study include the comprehensiveness of the data, the large sample size, and low amounts of missing data. However, some limitations are worth noting. First, it was not possible to do a formal and separate validation of the codes and algorithms used to select the study population, and our linkage procedures, coding variations, and the exact coverage of the registries were not formally assessed. The population of individuals with a history of admission to hospital because of a mental illness might have differing mortality to those who have never been admitted to hospital, or treated, or both, and the direction of this difference requires additional research. Overestimation of mortality is possible since individuals with a history of discharge from a psychiatric hospital represent more severe cases of illness than do those without. However, there could also be fewer deaths among patients treated in hospital than among those never treated in hospital because inpatients would receive more intense treatment. We used data of patients discharged from inpatient facilities, where patients with mild mental and behavioural disorders are less likely to be treated, and our findings should therefore be generalised with caution to similar populations only. Second, our study design excluded individuals who died before 2014. This exclusion might have diluted the true effect of mental disorders on mortality through selection of individuals with a longer disease duration. Additionally, our results might underestimate mortality because individuals with substance use disorders and with somatic comorbidities, and thus plausibly shorter survival with disease, could have been systematically under-represented. Another potential limitation is that we were not able to take into account all the important risk factors beyond the presented mental disorders—for example, tobacco smoking. Although nicotine dependence is an important condition with additional health risks, it is rarely recorded in the Czech Republic, and separate analysis of this risk factor was not possible.

Comparisons with studies done in other countries are not straightforward because the nature and purpose of registries, as well as access to and linkage of registry data, markedly differ between health systems and regions. Moreover, register-based studies are affected by unknown geographical and temporal variations in diagnostic and coding practices, and quality of data, which are not purposely collected to address and answer specific research questions.<sup>13</sup> Nevertheless, our results are mostly in line with those of previous studies. Evidence from recent systematic reviews showing the marked, disproportionate mortality associated with mental and neurological disorders is robust and consistent across several studies done in Scandinavia, western Europe, North America, Asia, and Australia.<sup>14</sup> The mortality ratio in individuals diagnosed with mental and neurological disorders compared with the general population was

shown to be high among individuals with substance use disorders (opiate use: 14.7 [95% CI 12.8–16.5];<sup>15</sup> amphetamine: 6.2 [4.6–8.3];<sup>16</sup> alcohol: 4.6 [2.7–7.7]);<sup>3</sup> anorexia nervosa (5.8 [4.2–8.3]);<sup>17</sup> schizophrenia (2.5 [2.2–2.4] to 4.7 [4.1–5.3]);<sup>18,19</sup> depression (1.5 [1.4–1.6]);<sup>20</sup> and other conditions (acute and transient psychosis: 4.7 [4.1–5.3]; bipolar disorder: 3.3 [2.8–3.8]).<sup>19</sup>

The complex association between physical and mental health provides some potential explanations for this gap in mortality.<sup>21</sup> Mental and somatic disorders often co-occur because of shared risk factors and common pathological pathways. Poor mental health might delay help seeking and might affect the detection, diagnosis, and prognosis of both communicable and non-communicable diseases. Moreover, although chronic diseases can cause or worsen mental disorders because of the associated disability and burden (and through the side-effects of medications on the CNS), access to care, help-seeking, and adherence to treatment might be poor in people with mental disorders. Poor longitudinal continuity of care,<sup>22</sup> loneliness,<sup>23</sup> an unhealthy lifestyle, poor health literacy, absence of health-promoting behaviours, structural issues, and social determinants of health (eg, relative poverty) are among other potential factors contributing to the excess mortality.<sup>2</sup> A combination of all these factors might explain the increased mortality due to different health conditions, particularly due to symptoms, signs, and abnormal clinical and laboratory findings, diseases of the nervous, respiratory, and circulatory systems, and directly caused by mental and behavioural disorders. Increased mortality due to gastrointestinal disorders might be linked to increased liver and gastric problems associated with alcohol and substance use disorders.<sup>24,25</sup> Finally, schizophrenia and common mental health disorders such as depression and substance abuse are the main proximal risk factors for suicide, which is the second leading cause of death in young adults (<30 years) globally.<sup>3,26</sup> The high mortality due to intentional self-harm in our study corresponds with other research showing heightened rates of suicide, unintentional injuries,<sup>27</sup> and likelihood of being a victim of homicide among people with mental disorders, which might partially explain the differences in mortality from external causes of death.<sup>28</sup>

Our data provide a strong evidence base for the substantial life expectancy gap in people with mental disorders in the central and eastern Europe region. Our findings are particularly important in the context of the ongoing mental health-care reforms in the Czech Republic. Strengthening of suicide prevention efforts and provision of better mental and physical care for people with mental illnesses, as outlined in the WHO Comprehensive Mental Health Action Plan 2013–2020, is crucial.<sup>29</sup> Mortality and its monitoring over time have been included among the key preliminary indicators of the proposed mental health national plan in the Czech Republic to closely monitor progress in quality of mental health care.<sup>11</sup> Data will be routinely collected to assess the

development of mental health-care services in the country. Because of the scarcity of epidemiological evidence from other countries in central and eastern Europe, further research is urgently needed to inform and propel mental health promotion, disease prevention, and policy and health-systems responses aimed at closing the life expectancy gap in people with mental disorders, and addressing the largely unmet mental health needs in the region.

# Contributors

DK initiated, planned, and designed the study, identified collaborators, coordinated data analysis and prepared the first draft of the Article. KM participated in planning and designing the study, extracted and analysed data, and participated in writing the draft of the paper. PW assisted with planning and designing the study, took part in data analysis, and provided valuable comments to the paper draft. YK participated in planning the study and provided important comments on the stage of data analysis, manuscript preparation, and review. EA supervised the whole project from the beginning and helped to make many strategic decisions, and assisted with planning and designing the study, data analysis, and writing and revision of the manuscript.

# Declaration of interests

We declare no competing interests.

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